(Paper-VIII)
B.A. Part- III
Symbolic Logic
"Argument Form and Truth Table"

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Symbolize the following:-

a. *Conjunction* **(.)** : Roses are red and violets are blue.

Roses are red (p) p . q

violets are blue(q)

and (.)

b. *Negation* **(˜)** : Lead is not heavier than gold.

˜ L

c. *Disjunction* (v) : Tea or coffee.

Tea (p) p v q

Coffee(q)

Or(v)

NUMERICAL QUESTIONS:

1. Rossy and belly is not both be selected.

Rossy –p , belly-q , and-(.) , not (˜)

˜ (p . q)

2. The words of his mouth were smoother than butter, but war was in his heart.

The words of his mouth were smoother than butter-(p)

war was in his heart(q)

p . q

1. Either Atlanta wins their conference championship and Baltimore wins their conference championship or chicago wins the superbowl.

Atlanta wins their conference championship- (p)

Baltimore wins their conference championship-(q)

Chicago wins the superbowl-(r)

$$(p \,.\, q) \vee r$$

4. If Alice is elected class president, then either Betty is elected vice- president or Carol is elected treasurer. Betty is elected vice- president. Therefore, if Alice is elected class- president, then Carol is not elected treasurer.

Implication - Ↄ means if, then

Alice is elected class president (p) , Betty is elected vice- president (q) , Carol is elected treasurer (r)

$$p \supset (q \vee r)$$

$$q$$

$$\therefore\ p \supset \sim r$$

Truth Table : ˜ p - Negation of p

p v q – Disjunction

p . q – Conjunction

p Ɔ q - Implication

p	q	˜ p	˜ q	p . q	p v q	pƆq
T	T	F	F	T	T	T
T	F	F	T	F	T	F
F	T	T	F	F	T	T
F	F	T	T	F	F	T

Use truth tables to determine the validity or invalidity of the following argument forms:

1. p . q
   ❖ p

p	q	p . q	p
T	T	T	T
T	F	F	T
F	T	F	F
F	F	F	F

Ans. - Valid

2. p
   ❖ q Ↄ p

p	q	p	q Ↄ p
T	T	T	T
T	F	T	T
F	T	F	F
F	F	F	T

Ans. Valid

3. $p \supset (q \supset r)$

$p \supset q$

❖ $q \supset r$

Ans. Invalid

Shown by 6th row

p	q	r	$p \supset (q \supset r)$	$p \supset q$	$q \supset r$
T	T	T	T	T	T
T	T	F	F	T	F
T	F	T	T	F	T
T	F	F	T	F	T
F	T	T	T	T	T
F	T	F	T	T	F
F	F	T	T	T	T
F	F	F	T	T	T

Statement Forms: we define it any sequence of symbols containing statement variables, such that when statements are substituted for the statement variables- the same statement being substituted for every occurrence of the same statement variable throughout – the result is a statement.

For example, A, B, and C are different simple statements, the compound statement A .(B v C) is a substitution instance of the statement form p . q, and also of the statement form p.(q v r), but only the latter is the specific form of the given statement.

Tautology: A statement form that has only true substitution instance is said to be tautologous, or a tautology

The truth table of tautology -

p	~ p	p v ~ p
T	F	T
F	T	T

Contradiction: A statement form that has only false substitution instances is said to be contradiction.

p	~ p	p . ~ p
T	F	F
F	T	F

Contingent : A statement form that has both true and false substitution instances is said to be contingent.

p	**q**	**p . q**
T	T	T
T	F	F
F	T	F
F	F	F

p	**q**	**p ≡q**
T	T	T
T	F	F
F	T	F
F	F	F

Materially Equivalent: Two statements are said to be materially equivalent when they have the same truth value, and we symbolize it by inserting the symbol '≡' between them. symbol '≡' may be read 'if and only if' and also called a biconditional.

Logically Equivalent: Two statements are said to be logically equivalent when the biconditional express the material equivalence is a tautology. $(p \equiv \sim\sim p)$

p	$\sim\sim p$	$p \equiv \sim\sim p$
T	T	T
F	F	T

Exercises:

1. Use truth tables to characterize the following statement forms as tautologous, contradictory, or contingent:

1. (p . q) Ɔ ˜ p
2. (p Ɔ P) Ɔ (q . p)
3. p Ɔ q Ɔ [(q v r) Ɔ ˜ (r . p)]
4. (p . q) Ɔ q

2. Use truth tables to decide which of the following are logical equivalences:

1. (p Ɔ q) ≡ (˜ p Ɔ ˜ q)

2. $[\, p \lor (q \,.\, r) \,] \equiv (\sim q \supset \sim p)$

3. $[\, (p \,.\, q) \supset (p \lor r) \,] \equiv [\, (q \lor r) \supset \sim (r \,.\, p) \,]$

4. $\sim (p \supset q) \equiv [\, (q \,.\, r) \supset \sim (r \,.\, \lor p) \,]$

3.Use truth tables to determine the validity and invalidity of each of the following argument forms:

1. $p \lor q$

   p

   ∴ **q**

2. $p \supset q$

   $p \lor q$

   ∴ **q**

Reference:

- Copi ,Irving M., “Symbolic Logic”, 5th ed. (New Delhi: Pearson India Education Services Pvt. Ltd, 2015), 20-31.
- Basson, A. H. and O’Connor, D. J., “ Introduction to Symbolic Logic”(New Delhi: Oxford University Press, 1956), 143-148.

THANK YOU